NON-PUBLIC?: N
ACCESSION #: 9408220236
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Nine Mile Point Unit 1 PAGE: 1 OF 6

DOCKET NUMBER: 05000220

TITLE: Reactor Scram on High Neutron Flux Caused by an
Electrical Pressure Regulator Malfunction
EVENT DATE: 07/11/94 LER #: 94-005-00 REPORT DATE: 08/10/94

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: N POWER LEVEL: 085

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: K. J. Sweet, Manager Technical Support TELEPHONE: (315) 349-2462
NMP1

COMPONENT FAILURE DESCRIPTION:
CAUSE: X SYSTEM: TG COMPONENT: PC MANUFACTURER: G080
X BJ PS M235
B JD CON G80
REPORTABLE NPRDS: Y
Y
N

SUPPLEMENTAL REPORT EXPECTED: YES EXPECTED SUBMISSION DATE: 02/28/95

ABSTRACT:

On July 11, 1994 at 0001 hours, with the reactor mode switch in the "RUN" position and reactor power at approximately 85 percent, Nine Mile Point Unit 1 (NMP1) experienced a Reactor Protection System (RPS) actuation. Specifically, a full reactor scram was caused by neutron flux exceeding the flow-biased Average Power Range Monitor (APRM) scram setpoint. Additionally, the turbine tripped and the High Pressure Coolant Injection (HPCI) System initiated on the turbine trip, as expected.

The immediate cause of this event was a malfunction in the Turbine

Control System's Electrical Pressure Regulator (EPR). Extensive troubleshooting of the EPR failed to pinpoint the exact malfunction but has narrowed the cause of the malfunction to selected components within the EPR. A formal root cause analysis will be completed when failure analysis of these components is obtained from the EPR vendor.

The EPR's operational amplifier and steam line resonance compensator were replaced. Additional Data Acquisition & Analysis System (DAAS) points were added to the steam line resonance compensator for on-line monitoring. The mercoid switch for #12 Feedwater Pump suction pressure was replaced. An electrical connector for control rod position indication was repaired.

END OF ABSTRACT

I. DESCRIPTION OF EVENT

On July 11, 1994 at 0001 hours, with the reactor mode switch in the "RUN" position and reactor power at approximately 85 percent, Nine Mile Point Unit 1 (NMP1) experienced a Reactor Protection System (RPS) actuation. Specifically, a full reactor scram was caused by neutron flux exceeding the flow-biased Average Power Range Monitor (APRM) scram setpoint. Additionally, the turbine tripped and the High Pressure Coolant Injection (HPCI) System initiated on the turbine trip, as expected.

NMP1 utilizes the Mechanical Hydraulic Control (MHC) turbine control system. Prior to the scram, the Electrical Pressure Regulator (EPR) was controlling reactor pressure. Approximately 3 seconds prior to the scram, the EPR malfunctioned, sending a full open signal to the Turbine Control Valves (TCVs). The TCVs responded as expected and opened further, causing reactor pressure to decrease. As reactor pressure decreased, increased voiding in the core caused neutron flux to decrease. The EPR malfunction lasted for approximately 0.75 seconds. The EPR then attempted to restore reactor pressure by sending a close signal to the TCVs. As the TCVs closed, reactor pressure increased, collapsing voids in the core. This caused the neutron flux to increase until the APRM flow-biased scram setpoint was reached, at approximately 107 percent of rated neutron flux.

Following the scram signal, all control rods fully inserted. The turbine tripped 5 seconds after the scram signal, and the generator tripped 5 seconds after the turbine trip, as expected. HPCI initiated on the turbine trip signal, as expected. The coastdown of the main turbine driven feedwater pump brought reactor water level up to greater than 100

inches (scale). The lowest reactor water level reached was 22 inches (scale), which is 107 inches above top of active fuel. The maximum Reactor Pressure Vessel (RPV) pressure reached was 1007 psig and the minimum pressure was 994 psig.

Several problems were identified upon review of this event:

1. Feedwater Pump (FWP) #12 tripped on low suction pressure, as expected for plant conditions, shortly after initiating in the HPCI mode. However, when suction pressure returned to normal the suction pressure switch did not reset, requiring mechanical agitation of the switch to allow restart of #12 FWP, had it been required.

2. Following the main generator trip and during the fast transfer of 4.16 KV Power Boards 11 and 12 from station service to reserve (offsite 115 KV) power, a minor electrical transient occurred. A review of the power distribution system's monitoring data indicate that a measurable decrease in frequency occurred on the electrical grid when NMP1 tripped off-line. This minor electrical transient, in conjunction with the fast transfer, caused several Area Radiation Monitor (ARM) false alarms, the turbine building mercury vapor lights to momentarily de-energize, and protective relays for Instrument and Control (I&C) Bus 130A to operate. I&C Bus 130A de-energized, but returned to normal 17

I. DESCRIPTION OF EVENT (Cont'd)

seconds later. I&C Bus 130A provides a manually aligned maintenance power supply for RPS buses and Reactor Trip buses, but had no loads at the time of this event.

3. The scram times for two control rods (42-23 and 50-23) did not print on the 30 channel scram time recorder. Additionally, these two control rods and control rod 34-23 did not have a lit rod drift light following the scram, as would normally be expected.

All other plant systems responded as expected. Operators continued scram recovery per plant procedures and commenced reactor cooldown to the cold shutdown condition.

II. CAUSE OF EVENT

The immediate cause of this event was a malfunction in the EPR. Extensive troubleshooting of the EPR by Niagara Mohawk Power Corporation

(NMPC) personnel, and analysis and reviews by NMPC and General Electric personnel, have narrowed the potential causes of the malfunction to either the operational amplifier or the Steam Line Resonance Compensator (SLRC) in the EPR. These components will undergo failure analysis to determine the root cause. Based on this analysis, if the cause or corrective actions of this LER should change, a Supplemental Report will be issued.

III. ANALYSIS OF EVENT

This event is reportable in accordance with 10CFR50.73 (a)(2)(iv), "any event or condition that resulted in manual or automatic actuation of any Engineered Safety Feature (ESF), including the Reactor Protection System (RPS)."

The flow biased APRM scram is an automatic Reactor Protection System action to prevent exceeding a fuel cladding safety limit. The integrity of the fuel clad as a barrier to the release of fission products is assured if a safety limit is not exceeded. In this event, as the turbine control valves closed, reactor pressure increased and the flow-biased APRM scram setpoint was reached. The initiation of the flow-biased APRM scram is a protective mode of operation, and it performed its intended function. A high reactor pressure scram was available as a backup to the flow-biased APRM scram.

The tripping of #12 FWP, due to low suction pressure when HPCI initiates and the main turbine driven feedwater pump is providing significant flow, has previously been evaluated and found to be in conformance with design. In this event, mechanical agitation of the low suction pressure switch was required to reset it and allow restart of #12 FWP, had it been required. HPCI was not necessary to recover reactor water level because the feedwater flow provided by the main

III. ANALYSIS OF EVENT (Cont'd)

turbine-shaft driven feedwater pump was sufficient. Additionally, the redundant #11 FWP was running in the HPCI mode in full recirculation back to t
e condenser, and available if needed.

It is surmised that the minor electrical transient on the off-site power system during the fast transfer of 4.16 KV Power Boards 11 and 12 to reserve power caused a momentary voltage transient on the 600 V power distribution system. The voltage transient then caused the momentary

de-energization of the mercury vapor lights, and a momentary voltage interruption to ARM power supplies, resulting in false ARM alarms. One upscale and five downscale lights were lit for individual ARMS. No computer points were recorded for these alarms, which indicates that the condition cleared immediately. The control room meter for the single ARM with the upscale light was verified to have normal background indication by control room operators. Further, by design, under frequency, undervoltage and overvoltage protective relays automatically de-energize I&C Bus 130A during such electrical transients. The time delay for restoration of these relays is 15 seconds, which explains why the bus was re-energized 17 seconds later (as measured by the process computer). Therefore, the relays operated as designed.

No loads were applied to I&C Bus 130A at the time of the scram, hence there was no significance to the bus being de-energized for 17 seconds. However, I&C Bus 130A can be utilized by manual operator action as a maintenance power supply for RPS Buses 11 and 12 and Reactor Trip Buses 131 and 141. All systems on the RPS buses or reactor trip buses fail safe upon de-energization except for the Automatic Depressurization System (ADS) which requires at least one RPS bus to initiate. Only one RPS bus or reactor trip bus is allowed on I&C Bus 130A at a time. Therefore, even with the loss of one RPS bus, ADS would still be functional from the alternate RPS bus.

Scram times for 28 of 30 control rods were measured and were within Technical Specification requirements. For the two control rods that did not print on the scram time recorder, rods 42-23 and 50-23, troubleshooting revealed an incorrectly assembled J3Y2 connector in the reactor manual control system interface panel. This condition would also have prevented the control room rod drift annunciator from alarming if these control rods had drifted. Additionally, the same incorrectly assembled connector was the cause of the loss of the rod drift light for control rod 34-23. This condition has likely existed since the original assembly of this connector, during the 1981 upgrade of the RPIS System, as no record of previous work associated with this connector was found. Inoperability of the drift light for these control rods is of minimal significance since frequent surveillances of control rod position would have identified these control rods as mis-positioned, should they have drifted during this time period.

There were no adverse safety consequences as a result of this event, nor was the reactor in an unsafe condition during or after this event. There were no adverse consequences to the health and safety of the general public or plant personnel as a result of this event.

IV. CORRECTIVE ACTIONS

The following corrective actions were taken:

1. Extensive troubleshooting of the EPR failed to pinpoint the exact malfunction, but has narrowed the cause of the malfunction to either the operational amplifier or the Steam Line Resonance Compensator. Both components were replaced and the EPR was calibrated. These components will undergo failure analysis to determine the root cause of the EPR malfunction.

2. Four (4) additional DAAS points were added to the EPR circuitry to improve diagnostic capability of SLRC functions.

3. Work Order 94-02635-00 was written to investigate/repair the #12 FWP suction pressure mercoid switch. The switch was replaced after identifying that the reset function was not working properly.

4. Procedure N1-ESP-RPS-330, "130A Maintenance, Bus Instrument Channel Test Excluding Output Contacts," was satisfactorily performed to ensure operability of I&C Bus 130A.

5. The connector for control rods 34-23, 42-23 and 50-23 was repaired and tested satisfactorily. This corrected the scram time recording problem with two of the control rods, and the drift annunciator problem with all three control rods. The alarm response procedure for the control rod drift annunciator has been revised to require operators to identify any unlit rod drift lights after a scram.

V. ADDITIONAL INFORMATION

A. Failed components:

The Electrical Pressure Regulator's Operational Amplifier 2A, and/or the Steam Line Resonance Compensator; the #12 FWP low suction pressure mercoid switch; and the J3Y2 connector in the Reactor Manual Control System interface panel

B. Previous similar events:

LER 92-03 describes a scram from approximately 97 percent power due to loose, oxidized and intermittent electrical connections at one of the EPRs four Linear Variable Differential Transformers (LVDTs), and also due to electrical noise between adjacent field wiring.

LER 87-14 describes a scram from 88.5 percent power due to high neutron flux. A stuck servo valve in the Electrical Pressure Regulator hydraulic actuator caused Turbine Control Valve oscillations, and the resulting scram.

V. ADDITIONAL INFORMATION (Cont'd)

LER 85-05 describes a reactor scram from power due to high neutron flux. The electrical pressure regulator was in control at the time of the scram, however, maintenance on the mechanical pressure regulator found the stroke to be binding and sticky.

The corrective actions from these previous similar events would not have prevented this event from occurring.

C. Identification of components referred to in this LER:

COMPONENT IEEE 803 FUNCTION IEEE 805 SYSTEM ID

Reactor Protection System N/A JC
High Pressure Coolant Injection System N/A BJ
Mechanical Hydraulic Control (MHC)
Turbine Control System N/A TG
Average Power Range Monitor RI AC
Feedwater Pump P SJ
Turbine Flow Control Valves FCV TG
Electric Pressure Regulator PC TG
Turbine Generator TRB TG
HPCI Suction Pressure Switch PS BJ
4.16 KV Power Board JX EA
Area Radiation Monitors MON IL
Protective Relays Time Delay 62 EC
Instrument Maintenance Bus BU EC
Nuclear Reactor RCT N/A
Reactor Manual Control System Interface
Panel J3Y2 Connector CON JD

NIAGARA
MOHAWK

NIAGARA MOHAWK POWER CORPORATION/Nine Mile Point Nuclear Station Unit #1,

P. O. Box 63, Lycoming, NY 13093

Richard S. Abbott
Plant Manager

(315) 349-1812
(315) 349-4417 (FAX) August 10, 1994
NMP1L 0846

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

RE: Docket No. 50-220
LER 94-05

Gentlemen:

In accordance with 10CFR50.73 (a)(2)(iv), we are submitting LER 94-05, "Reactor Scram on High Neutron Flux Caused by an Electrical Pressure Regulator Malfunction."

A telephone report of this event was made in accordance with 10CFR50.72 (b)(2)(ii) at 0051 hours on July 11, 1994.

Very truly yours,

R. B. Abbott
Plant Manager - NMP1

RBA/JTP/lmc
Attachment

xc: Mr. Thomas T. Martin, Regional Administrator, Region I
Mr. Barry S. Norris, Senior Resident Inspector

*** END OF DOCUMENT ***